WINDOWS AND WINDOW FRAMES

WINDOWS

WHEN TO CONSIDER

NEEDS ASSESSMENT	NO	SCHEMATIC DESIGN	YES
MASTER PLANNING	NO	DESIGN DEVELOPMENT	YES
PROJECT STATEMENT	MAYBE	CONSTRUCTION DOCUMENTS	DONE
ARCHITECTURAL PROGRAMMING	YES	CONSTRUCTION	DONE

NO-Need not consider.
MAYBE-This system may be considered.
YES-This system should be considered.
DONE-This system should have already been considered.

DESCRIPTION

Windows in the facility let light in and allow visibility to adjacent areas in and out of the building, Windows in this discussion consist of the frame and glazing.

RELATIONSHIP TO OTHER SYSTEMS

Window frames, like door frames, may be an integral part of the interior and exterior partitions. Some combinations of partitions and frames may not require the frame prior to installing the wall; check with your architect, However, generally the frame should be available when the wall is being installed.

Delivery of window frames is almost always a problem. Due to the limited competition and the ambitious correctional construction program ongoing across the nation, the manufacturers are overextended. Deliveries of the hollow metal can take 12 to 24 weeks from the approval of shop drawings.

ALTERNATIVES

Glazing Products

Note: Glazing information was excerpted from the Security Testing Glazing Program and Recommendations, July 10, 1985, prepared by Kitchell CEM for the State of California Deportment of Corrections. Security glazing products are evaluated in four basic categories which are inclusive of all of the security glazing types generally available in the market today. These are:

- Laminated glass
- Laminated polycarbonate
- Laminated glass and polycarbonate
- Air-separated products using the above

Glass Products

Glass products are comparatively low in strength but high in heat and scratch resistance. Annealed gross, strengthened glass and special glass will be discussed.

Annealed Glass. This is the basic glass product used by the industry for general purposes. Annealed glass is often further processed by strengthening, tinting, coating, etc. to produce special qualities. In security applications, annealed glass is usually strengthened and laminated with similar or other materials.

In bullet resistant products, it is often laminated in its pure form due to its ability to flatten bullets and its breakage pattern which reduces vision the least of all products when shattered.

Strengthened Glass. This glass may be strengthened either by heat or chemical treatment, increasing its tensile strength.

Fully tempered glass will fracture into small cubes or pebblelike fragments when broken. If the glass is laminated, it will stay in place, completely obscuring vision. For this reason it is most often used as a single piece and not as a laminate. Semi-tempered glass approaches the strength of fully tempered glass but has the breakage characteristics of annealed glass, making it more appropriate for laminates.

Heat treatment tends to produce minor distortions of vision through glass. Generally, this may not be objectionable, however, under conditions of constant surveillance through glass this could become highly objectionable. Heat-treated glass products must be cut to size, including cut-outs, prior to treatment, as any cut through the compression layer after treatment will fracture the product. Annealed glass and polycarbonate may be cut at any time, but this is not recommended due to loss of the compression layer at cut edge and resulting reduction of strength.

Special Purpose Glass. Most special purpose glass, such as tinted and reflective glasses, can be laminated with other materials and used in security glazing; however, those of most immediate concern to us are wire glass, tinted glass and mirror (one-way) glass.

Wire Glass. Wire glass is used where fire ratings are required. Wire glass is annealed glass, usually 1/4-inch thick, containing a layer of wire in the event of breakage by impact or heat. Wire glass can be laminated with other products.

Tinted Glass. Tinted glass for reducing solar heat gain and glare is available. It enhances the comfort level and decreases the light transmittance. The principal use for

this product is in control stations exposed to the building exterior.

Mirror Glass. Mirror glass permits one-way visibility. The room from which you do the viewing must be darker than the room being viewed. This glass is available in float, heat-strengthened and tempered forms.

Polycarbonates

Polycarbonate is a highly impact-resistant material used extensively in security glazing. Compared to glass of any type, it has high degrees of strength and flexibility with light weight and good insulating qualities. Its other features, when compared to glass, tend to be negative - low resistance to heat scratching, marring, discoloration and expansion.

Surface treatments significantly increase resistance to various forms of abrasions and discoloration; however, the performance of the product in these areas will not equal that of glass.

Interlayers

Laminations of glazing materials are adhered by interlayers of various chemical compositions and thicknesses. Interlayers not only adhere one lamination to another but actually impact significant additional strength to the product by way of shock absorption. The interlayer also serves to retard further breakage after an adjacent lamination has shattered. In the event of breakage, the interlayer holds the pieces in place, making it very difficult to separate a broken piece from the whole.

In general, the composite strength of a given thickness of a glass-laminated product will increase as the number of interlayers increase. This is not true, however, in bullet-resistant products because the interlayer has little resistance to bullets.

Special problems arise in laminated glass and polycorbonate products. Because polycorbonate has a coefficient of expansion eight times that of glass, the interlayer must be highly flexible, yet stable, to maintain bond throughout temperature extremes.

In conventional glass-laminated security products, except those with very high glass-to-interlayer ratios, the difference in the composite strength between the weakest and the strongest glass available (annealed vs. tempered) will represent a difference of only 3 to 7 percent of the composite strength of the product. Therefore, the type of glass selected will most often be determined by breakage

characteristics, qualities previously cited or trade and manufacturing considerations.

Laminated Glass. This glass has a wide variety of applications, from the thinner laminates for light security (burglar-resistant) to medium thickness for higher security needs to thicknesses of 1-114 inch and more which have excellent bullet-resistance qualities. These products may use annealed glass, strengthened glasses or various combinations. Although the outer face of this product can be "broken" with little difficulty, resistance to total penetration is relatively high.

Laminated Polycarbonate. Polycarbonates are produced in a variety of thicknesses. While the product is sometimes used monolithically, it is often laminated for its high strength. Planes of weakness sometimes appear as shear cracks. Laminating will minimize structural failures due to this phenomena. Comparatively thin products provide excellent resistance to impact. Heat resistance requires greater thicknesses and/or more laminations.

Laminated Glass and Polycarbonates. This product combines the best qualities of both materials - the impact resistance of polycarbonate and the heat and mar resistance of glass.

Due to the large difference in thermal expansion characteristics of glass and polycarbonate and the relative inelasticity of interlayers, delamination problems have occurred in this product in past years; however, recent improvements in interlayers have greatly reduced this problem.

Air Separated Glass and Polycarbonate. This product is produced in a wide variety of unit and component thicknesses and glazing types. It is most often used in high strength installations with polycorbonate separated from glass laminations by air. One advantage of this product is the elimination of potential delamination. Another advantage is that some of these windows can have, if specified, an outer layer of glass replaced without replacing the entire unit, thereby reducing life-cycle costs.

WINDOW FRAMES

DESCRIPTION

Hollow metal frames generally are the only options available for a secure setting. The gauge of the frame may vary depending on the level of security, 18,16,14 and 12-gauge hollow metal frames are available, although 18-gauge is a medium commercial gauge of door. Sixteen-

gauge frames are considerably less expensive than the heavier gauges and will do the same job in many cases. (Glazing actually determines the security of a window.) If you are unsure of the differences among gauges, get samples of each. It should be noted that hollow metal wall systems with security glazing will cost 5 to 10 times more than concrete or block security walls. Also, costs can be kept to a minimum with simple shapes. More angles, mullions, etc. drive cost.

For cell windows, however, metal angles have been used on some California jails and prisons in lieu of hollow metal frames. Bars may be used on cell windows in order to divide a larger window into sections equal to 5 inches thick. (Five inches currently is the accepted width.) An alternate approach to bars are the 5 inch slit windows. The window may be 5 inches horizontally or 5 inches vertically with the length as desired. The 5-inch slit window is less expensive than the window with bars. The window with bars does allow for more light. Both windows meet standards. Some escapes have occurred from windows with bars due to deficiencies in installation.

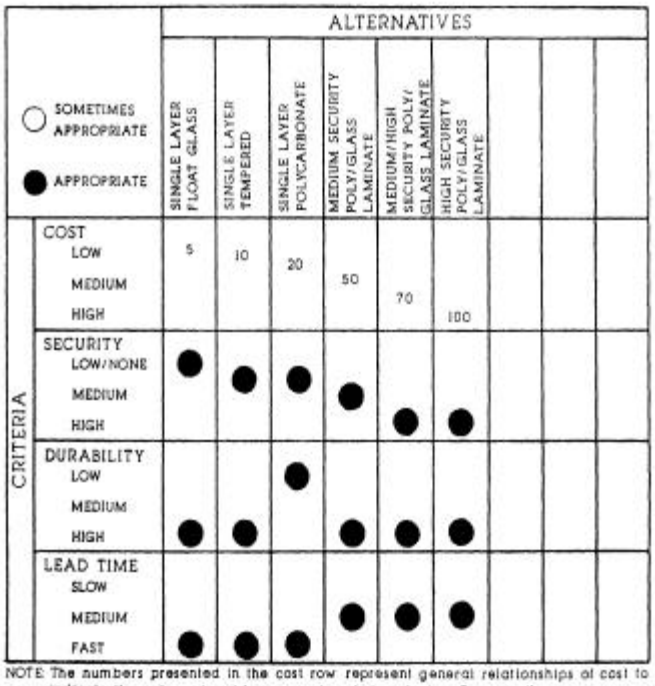
The metal angle window consisting of one metal angle installed to the wall below the glazing and another metal angle outside the glazing is less expensive than the hollow metal frame. The hollow metal frame, however, is more conventional and provides a more finished appearance. Another advantage to the metal angle slit window is that because the window is constructed of simple angle pieces, it is no longer a long lead item.

This new concept has been used on a few facilities outside of California. Glass brick is a solid piece of glass installed in a row or grouped in a masonry wall just as any other block would be installed. Glass brick doesn't require a frame and offers a level of security that rivals a bulletproof rating. The block, if scratched or marred, can be polished to reach its original translucency. On the other hand, the block distorts visibility and, if damaged, is difficult to replace.

SKYLIGHTS

Skylights offer long-term operational savings in lighting. Before agreeing to skylights though, make sure this long-term savings can be justified within a reasonable time period by your consultant.

Glazing Matrix



NOTE: The numbers presented in the cost row represent general relationships of cost to indicate the extremely wide range of costs for glazing. Because there are numerous combinations of security laminates possible specific products are not listed.